

REMARKS/ARGUMENTS

Claims 1-7, 9-36 are pending. Claim 8 has been canceled. Claims 1, 15, 20, 27, and 36 have been amended. Support for the claims can be found in the specification as originally filed. No new matter has been introduced by virtue of these amendments.

A telephonic interview with the Examiner was conducted on February 7, 2006. The Examiner suggested amending the claims to more clearly point out determining that one storage element within the pair of storage elements is to be accessed. The Examiner also suggested that an After Final response might be more appropriate at this time. Although an agreement was not reached, the undersigned is sincerely thankful to the Examiner for his observations and suggestions.

Claims 1-7, 9-36 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,601,101 to Lee et al. These claims rejections are overcome as follows.

The Present Invention

Embodiments in accordance with the present invention relate to preventing multiple host computers from concurrently utilizing the same disk drive of the same storage system at the same time. In Fig. 6 of the present specification, a pair of disk drives is shown:

[69] A pair is defined as a group of disk drives which represents a data mirroring unit. One of the disk drives within a pair is called a master disk drive and the others are called mirror disk drives. Host computers 16 and the storage system 12 share information as to which pairs have which disk drives. A disk drive is specified by an ID of the storage system 12 and an ID of a disk drive in the storage system 12. They are called SS ID and Vol ID respectively, A pair configuration table is used to maintain the ID information of each pair. Fig. 5 is an example of the pair configuration table.

[71] Fig. 6 shows an example of pairs. In Fig. 6, Pair1 includes three disk drives. Its master disk is a disk drive that has Vol ID 8 and resides in the storage system that has SS ID=1. The two mirrored disk drives reside in different storage systems, storage system SS ID=2 and storage system SS ID=3. Similarly, Pair2 includes two disk drives. As shown in Fig. 6, the master disk drive and the mirrored disk drive of Pair2 can be in the same storage system, storage system SS ID=1. (Emphasis added)

A determination is made as to which storage element within the pair of storage elements is to be accessed based upon use of the storage system. Fig. 10 of the present specification describes the determination process:

[81] The process sequence of the CFS server will now be described. Fig. 10 shows how the CFS server operates. After the CFS server is initiated, it waits for a request from the CFS clients. Typically, there are two kinds of requests, file open and file close.

[82] In the case of file open, the CFS server determines the pair name of the pair where the requested file is stored by using the file allocation table. Using the pair usage table, the CFS server then determines which disk drive in the pair is currently the least used. After that, the CFS server sends a file allocation list of the requested file with the mirror number of the least used disk drive to the requesting CFS client. Finally, the CFS server updates the pair usage table by incrementing the number of file opens on the least used disk drive. (Emphasis added)

Accordingly, claims 1-7, 9-36 recite the features of:

- (a) a plurality of storage elements organized into pairs for storing a plurality of files; and
- (b) when a client requests file information for a requested file from the file server, the file server determines which pair of storage elements has the requested file, and further determines which storage element within the pair of storage elements is to be accessed based upon use of the storage system.

Section 102(e) Rejections

The Lee reference does not disclose that disk drives are organized into pairs.

During the interview, the Examiner cited Figs. 2A and 3 of the Lee reference as disclosing “a plurality of storage elements organized into pairs for storing a plurality of files, each pair having a master storage element and at least one mirrored storage element.” Applicant respectfully asserts that Fig. 2A merely shows that the devices 130, 135, etc. could be disk drives among other devices. Lee does not teach that these devices could be disk drives organized into pairs. Specifically, in column 6, lines 45-51 of the Lee reference:

“The cluster consists of the switch 120 and cluster devices 130, 135, and 236. As described above, the cluster devices may be disk drives with file systems, web servers, database servers, networked computing clusters, load balancing servers switches or first devices which aggregate second devices, or any other device which would benefit from clustering.” (Emphasis added)

Here, while cluster devices 130, 135, and 236 may be grouped into one cluster, the Lee reference does not explicitly describe the cluster devices as further being organized into pairs representing a data mirroring unit. Although a plurality of disk drives are shown in Figs. 2A and 3, the disks are not shown to be organized into pairs, as recited in the claims. There is no description in column 6 of the Lee reference that describes the disk drives as being pairs, where the mirror disk drive has a copy of the data stored on the master disk drive.

The Lee reference does not disclose determining which storage element within the pair of storage elements is to be accessed based upon use of the storage system.

The Examiner observed that column 7, lines 35-58 of the Lee reference discloses “the file server maintains access load information regarding each one of the pair of storage elements.” *See Office Action at page 2.* The Lee reference teaches handing off a client request from a first device to a second device that is better suited to handle the client request. Fig. 3 shows an example of handing off. Here, a client and a first device participate in a series of transactions as indicated by the circle-3 communication exchanges. *Col. 7, lines 6-10.* The figure shows at circle-4 a situation where the first device determines that another device is better suited to handle the client request. *Id at lines 11-13.* A second device is then determined to which the request is to be handed off.

Lee discloses “any of several techniques” for identifying the second device. *Col. 7, line 35.* For example, if the first device is a disk drive having a virtual root directory then the first device itself can identify which second device the file is located. Comparing to the pending claims, this technique does not read the recited determining which storage element among paired storage elements to access a file, since Lee is talking about identifying which disk has the requested file and does not indicate that the file is stored in a pair of disk drives.

Lee also seems to disclose a technique for identifying the second device when the first device is a load balancing device. "When the first device is a load device, satisfactory measures for load balancing may include traffic through the switch, reported workload or available capacity of alternate devices, or analysis of the services being requested." *Col. 7, lines 54-58.* Though it *appears* that Lee is describing identification of the second device based on load balancing criteria, Lee clearly teaches that this load-balancing-based decision applies when the first device is a load balancing device. Compare with the recited "determines which pair of storage elements has the requested file" of claim 1. Lee teaches a load-balancing device, not a storage element.

The Lee reference does not teach or suggest the present invention. Here, when the first device is a load balancing device, the Lee reference teaches measuring the workload of the other devices to determine whether a handoff should proceed. On the other hand, when the first device is a disk drive, the Lee reference teaches this first disk drive as using a virtual root directory to identify a second device to handoff the client request. The Lee reference does not explicitly describe load balancing when the first device is a disk drive. Furthermore, the Lee reference does not teach a file server determining which pair of storage elements has a requested file, and further determining which storage element within the pair of storage elements is to be accessed based upon use of the storage system, as recited in the claims.

Based upon the failure of the Lee reference to disclose each and every element of the pending claims, it is respectfully asserted that claims 1-7, 9-36 are patentable. The Section 102 rejection of the claims is believed to be overcome.

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PATENT

CONCLUSION

In view of the foregoing, the Applicant believes all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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